



Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at <http://about.jstor.org/participate-jstor/individuals/early-journal-content>.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

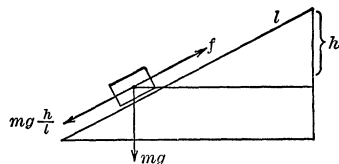
SOLUTION BY B. L. LIBBY, Ann Arbor, Mich.

Using the notations indicated in the figure, we have the resultant force acting upwards

$$f - mg \cdot \frac{h}{l}.$$

The acceleration required is therefore given by

$$a = \frac{fl - mgh}{ml}$$



Hence $dl/dt = (fl - mgh/ml)t$, and $l = (fl - mgh/2ml)t^2$, from which

$$t^2 = 2ml^2/(fl - mgh).$$

Differentiating, we have

$$t \frac{dt}{dl} = \frac{mfl^2 - 2m^2ghl}{(fl - mgh)^2}.$$

The usual test for a minimum for t gives

$$l = \frac{2mgh}{f} \quad \text{and} \quad t = 2m\sqrt{\frac{2gh}{f}}.$$

Also solved by HORACE OLSON and P. PEÑALVER.

347. Proposed by R. D. CARMICHAEL, Indiana Univ.

Show that the differential equation

$$9 \left(\frac{d^2y}{dx^2} \right)^2 \frac{d^5y}{dx^5} - 45 \frac{d^2y}{dx^2} \frac{d^3y}{dx^3} \frac{d^4y}{dx^4} + 40 \left(\frac{d^3y}{dx^3} \right)^3 = 0$$

remains unchanged when the variables x and y undergo any projective transformation.

SOLUTION BY A. M. HARDING, University of Ark.

Any projective transformation can be reduced to a succession of integral transformations of the form

$$x = aX + bY + c, \quad y = a_1X + b_1Y + c_1, \quad (1)$$

combined with the particular transformation

$$x = \frac{1}{X}, \quad y = \frac{Y}{X}.$$

Hence it will be sufficient to show that the given equation remains invariant under each of these transformations. From (1) we find

$$y' = \frac{a_1 + b_1Y'}{a + bY'}, \quad y'' = \frac{(ab_1 - a_1b)Y''}{(a + bY')^3}, \quad y''' = \frac{(ab_1 - a_1b)[(a + bY')Y''' - 3b(Y'')^2]}{(a + bY')^5},$$

$$y^{iv} = \frac{(ab_1 - a_1b)[(a + bY')^2 Y^{iv} - 10b(a + bY') Y'' Y''' + 15b^2(Y'')^3]}{(a + bY')^7},$$

$$y^v = \frac{[105(a + bY')b^2(Y'')^2 Y''' - 105b^3(Y'')^3]}{(a + bY')^9} + \frac{(ab_1 - a_1b)[(a + bY')^3 Y^v - 15b(a + bY')^2 Y'' Y^{iv} - 10b(a + bY')^2 (Y''')^2 + (Y'')^3]}{(a + bY')^9}$$

From (2) we find

$$y' = Y - XY', \quad y'' = X^3 Y'', \quad y''' = -X^4(3Y'' + XY'''),$$

$$y^{iv} = X^5[12Y'' + 8XY''' + X^2 Y^{iv}]$$

$$y^v = -X^6[60Y'' + 60XY''' + 15X^2 Y^{iv} + X^3 Y^v].$$

It can be easily shown by substitution that each transformation leaves the given equation invariant.

Also solved by J. W. CLAWSON and GEO. W. HARTWELL.

349. Proposed by C. N. SCHMALL, New York City.

If $y = a \cos(\log x) + b \sin(\log x)$, eliminate the constants a and b and obtain the equation

$$\frac{x^2 d^2 y}{dx^2} + \frac{xdy}{dx} + y = 0.$$

SOLUTION BY C. C. STECK, New Hampshire State College.

By differentiating the equation $y = a \cos(\log x) + b \sin(\log x)$, we obtain

$$\frac{xdy}{dx} = -a \sin(\log x) + b \cos(\log x).$$

Differentiating this and multiplying the resulting equation by x , we get

$$\frac{x^2 d^2 y}{dx^2} + \frac{xdy}{dx} = -a \cos(\log x) - b \sin(\log x) = -y.$$

From the last two equations readily follows the desired result

$$\frac{x^2 d^2 y}{dx^2} + \frac{xdy}{dx} + y = 0.$$

Also solved by M. E. GRABER, J. B. SMITH, J. W. CLAWSON, P. PEÑALVER, C. HORNING, ELMER SCHUYLER, A. M. HARDING, W. W. BEMAN, A. L. McCARTY, H. L. SLOBIN, CLIFFORD N. MILLS, FRANCIS RUST, I. A. BARNETT, F. C. REISLER, G. W. HARTWELL, S. W. REAVES, RICHARD MORRIS, ALBERT R. NAUER, BARNUM LIBBY, and WALTER C. EELLS.

351. Proposed by C. N. SCHMALL, New York City.

In the ellipse $(x^2/a^2) + (y^2/b^2) = 1$ are given e the eccentricity, and the angle φ which the normal at any point P (on the curve) makes with the major axis. If R is the radius of curvature at P prove that

$$R = \frac{a(1 - e^2)}{(1 - e^2 \sin^2 \varphi)^{\frac{3}{2}}}.$$